

Elk Valley Coal Mining and the Kootenai River: Impacts of Selenium on the Biota

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Acknowledgements



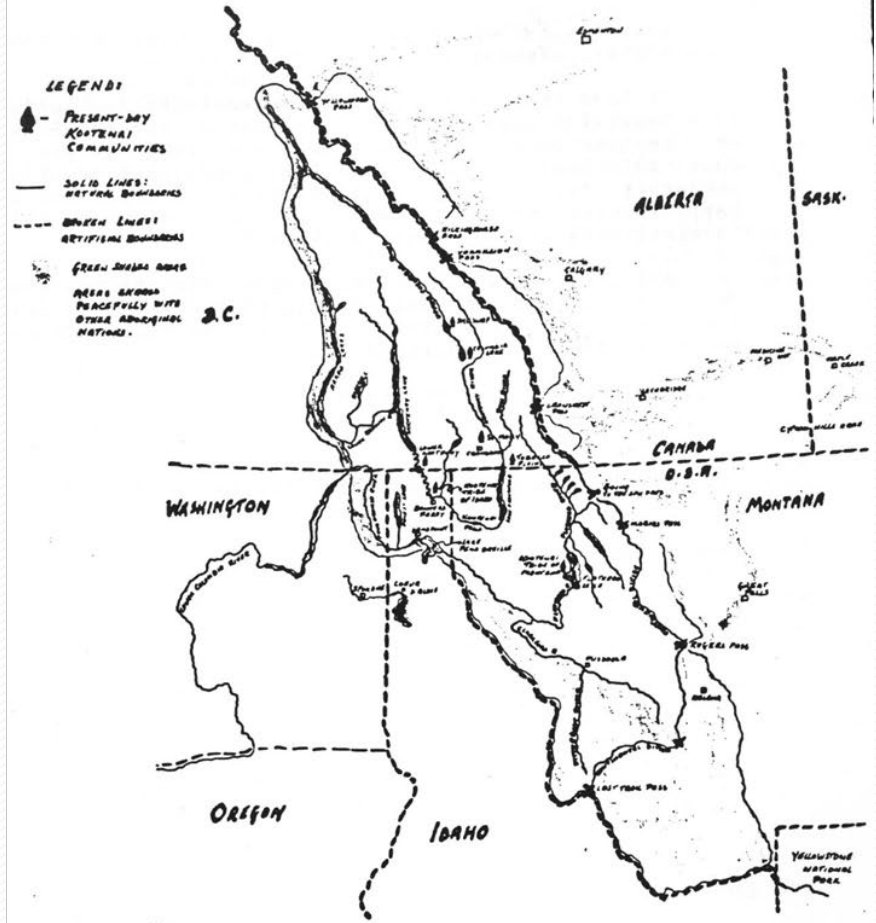
- Kootenai Tribe of Idaho Tribal Council and F&W Staff;
- EPA Region 8 and Region 10 Staff;
- US Fish and Wildlife Service (lab services);
- ALS Global and US EPA Manchester labs (lab services);
- US Geological Survey;
- MT FWP;
- Idaho Fish and Game;
- Idaho DEQ/MT DEQ;
- US ACoE.



photo credit: Genny Hoyle



Kootenai Aboriginal Territory



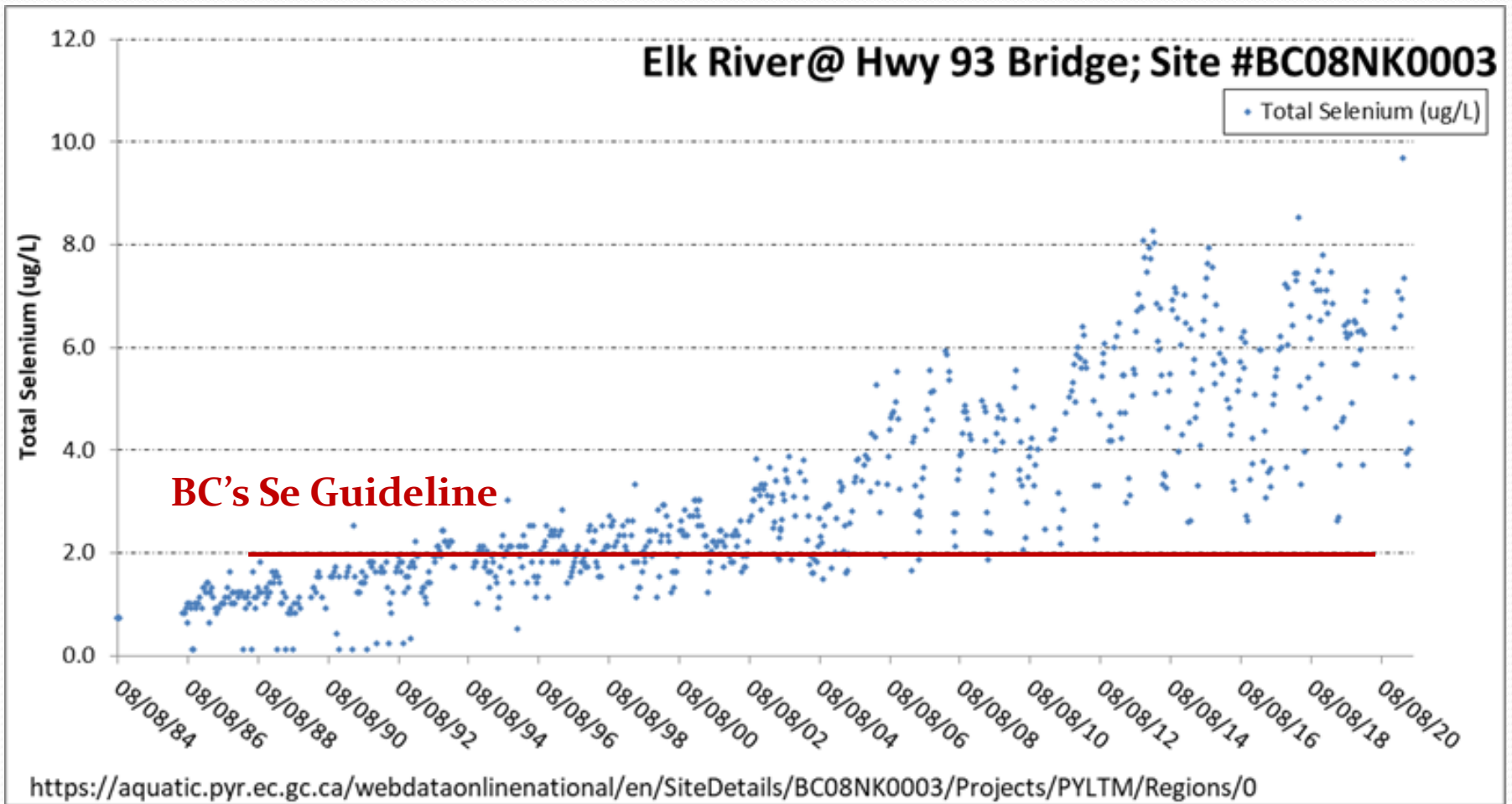
***KTOI slide prepared by S. Ireland*

Kootenai River Sub-Basin

- 9 million acres (19,420 sq mi)
- 485 miles long
- Ktunaxa Nation
- 2 Countries
- 2 States, 1 Province
- Endangered Species
- Hydropower
- Resource-based economy

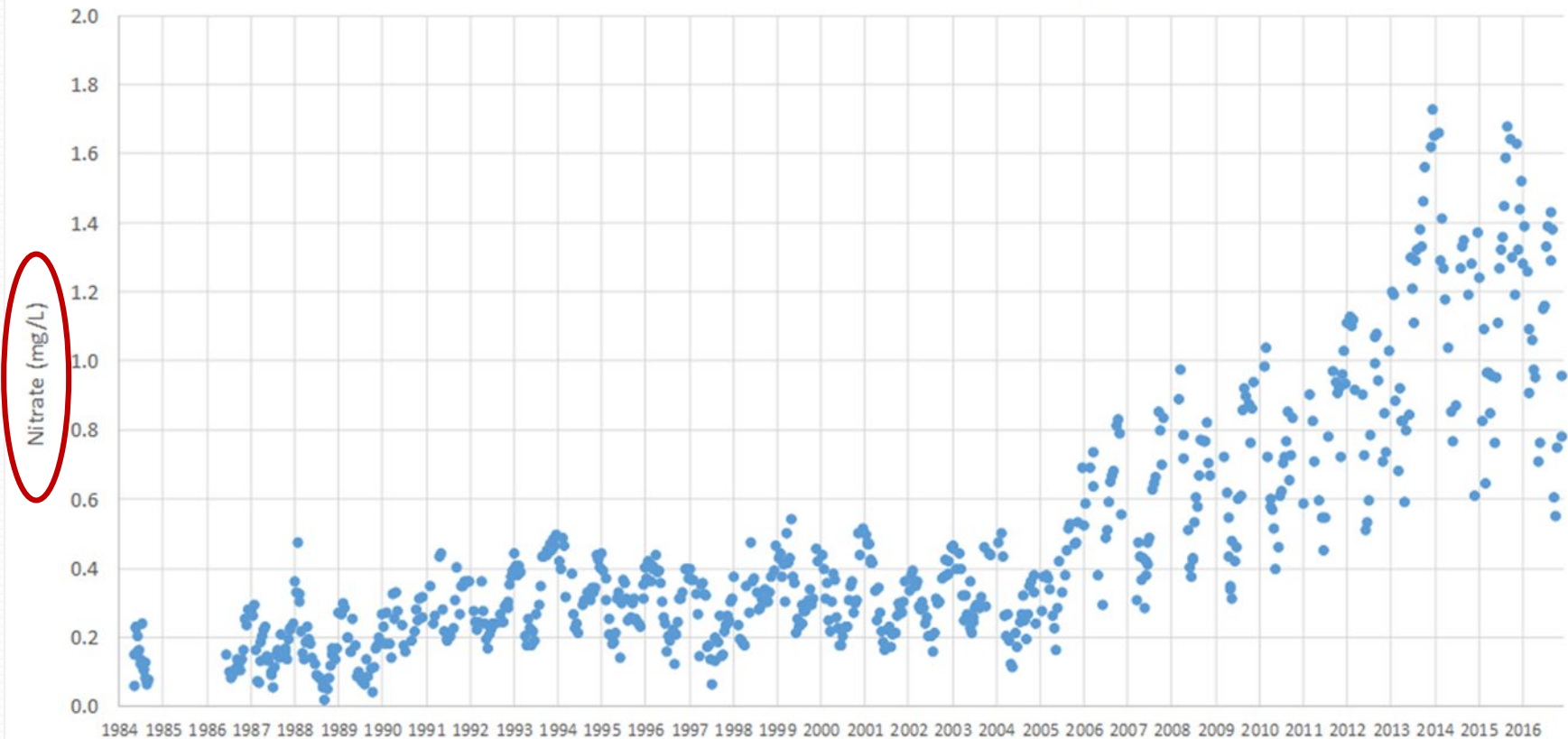


Water Chemistry - Selenium



Water Chemistry - Nitrogen

Elk River at Hwy 93 Crossing (near confluence with Lake Kocanusa)
Environment and Climate Change Canada (ECCC) Long-term Monitoring Station



Data download from <http://aquatic.pyr.ec.gc.ca/webdataonlinational/en/Measurements/ChooseVariables/Sites/BC08NK0003/Projects/PYLTM/Regions/0>
on June 13, 2017



Selenium

- Se is a nutritionally essential element for animals in small amounts; toxic at higher concentrations;
- Bio-accumulates in the aquatic food chain;
- Chronic exposure in fish and aquatic invertebrates can cause reproductive impairments (e.g., larval deformity or mortality);
- Selenium can also adversely affect juvenile growth and mortality;
- Selenium is also toxic to water fowl and other birds that consume aquatic organisms containing excessive levels of selenium.

Background — EPA Recommended Criteria

Criterion Version	Chronic					Short-term
	Egg-Ovary ¹ [mg/kg dw]	Whole Body ¹ [mg/kg dw]	Muscle ¹ [mg/kg dw]	Water Lentic ¹ [µg/L]	Water Lotic ¹ [µg/L]	Water ¹ [µg/L]
2016 Selenium Criterion	15.1	8.5	11.3	1.5 (30 day)	3.1 (30 day)	Intermittent exposure equation
1999 Selenium Criteria	N/A	N/A	N/A	5 (4 day)	5 (4 day)	Acute Equation based on water column concentration

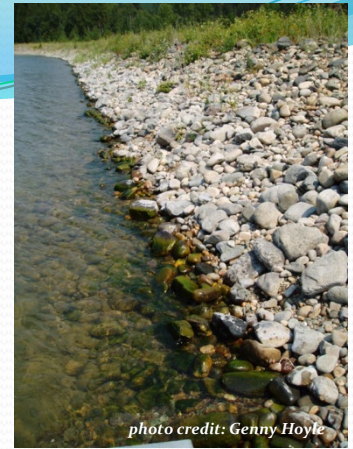
*EPA 2016 Selenium Fact Sheet; EPA 822-F-16-00

Initial Fish Sampling/Results

- 2018 USGS study results found “for eggs, 6 of the 8 mountain whitefish egg samples exceeded EPA’s recommended value.”
- <https://www.sciencebase.gov/catalog/item/5d6d38efe4b0c4f70cf62b74>;
- 2019 KTOI sampled 10 MWF egg and muscle – exceedances of IDEQ/EPA egg/ovary criteria in all 10;
- Idaho DEQ - 303d listing of a portion of the Kootenai River above Bonners Ferry in Idaho as ‘**impaired for selenium.**’

Monitoring Goals

- Ecosystem approach;
- Use existing long-term sites that provide trend data;
- Assess Se concentrations in the water, including speciation (selenate/selenite/'other');
- Investigate lower trophic levels;
- Monitor wetland water chemistry where larval and juvenile fish are stocked;
- Assess fish tissue concentrations in native fish with a focus on tissue types.



Sample Sites

- Sites were added (Kootenay River above Wardner);
- Metrics added to existing sites;
- KR tributaries added;
- N/P sampling added to Elk River.

Site Name	Location
KR16	Canal Flats, BC
KR15.5	Kootenay River @Wasa Bridge
Skookumchuck	Skookumchuck River, above pulp mill
KR15	Fort Steele, BC
Wild Horse River	Wild Horse River, BC
Bull River	Bull River, BC
KR14	Wardner, BC
Elk River	Elk River, BC
KR13	below Libby Dam, MT
KR10.5	Troy, MT
KR10	Yaak River confluence, MT
KR9	Hemlock bar
KR6	Cow Creek
KR4	Shorty's Island
KR3.5	Ferry Island
KR2	Porthill, ID
KR1	Kootenay Lake, BC, Canada
Nimz Pond	Nimz wetland
SF Trout Creek	South Fork Trout Creek wetland
Pelican Pond	Ball Creek TNC wetland

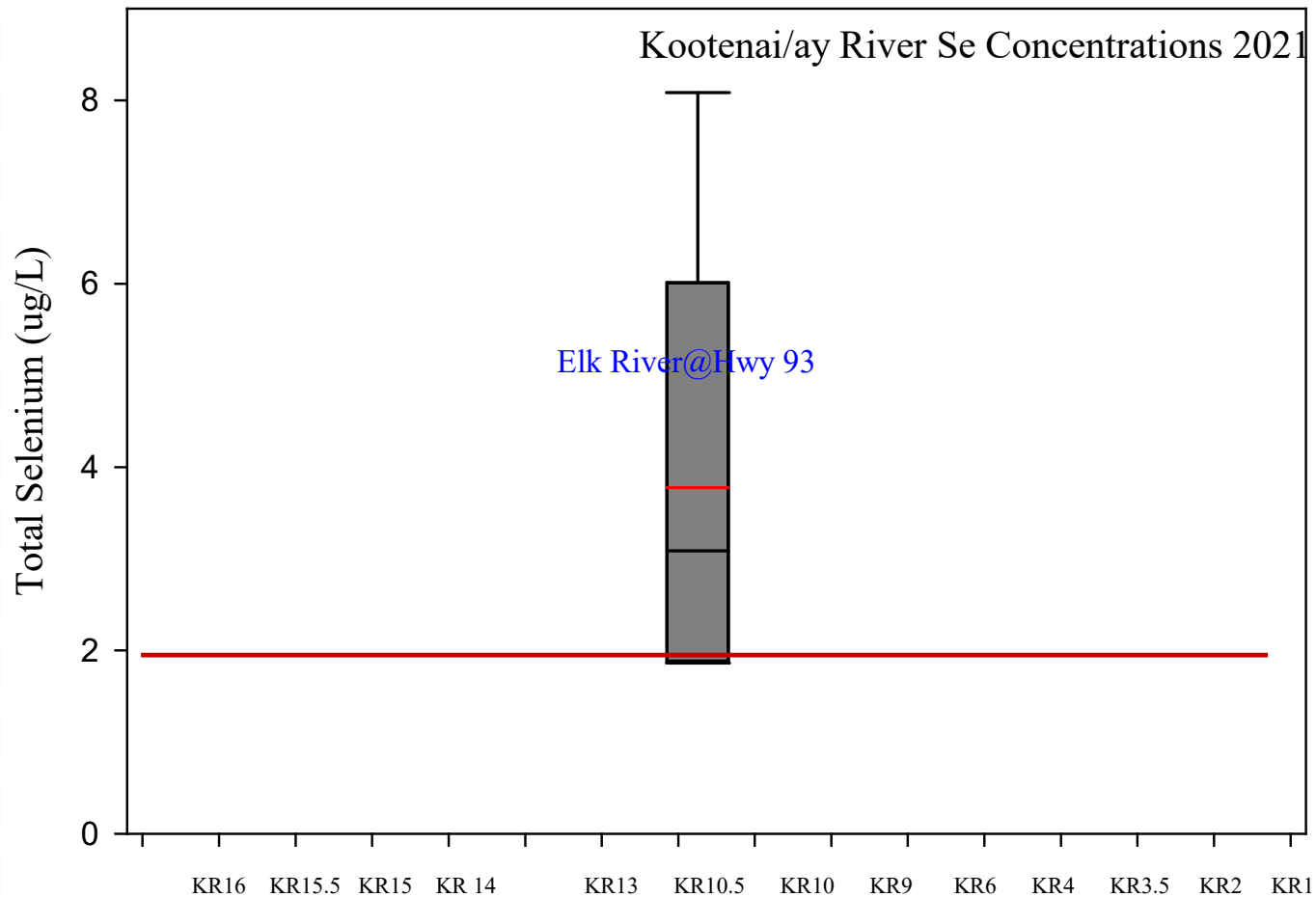
Water Chemistry

- Samples collected monthly from Canal Flats, BC, to Kootenay Lake, BC;
- BC rivers include the Skookumchuck, Wild Horse, Bull, and Elk rivers;
- Three lower Kootenai River wetlands sampled from March through September;
- 13 mainstem river sites; 4 tributary sites; 3 wetland sites.

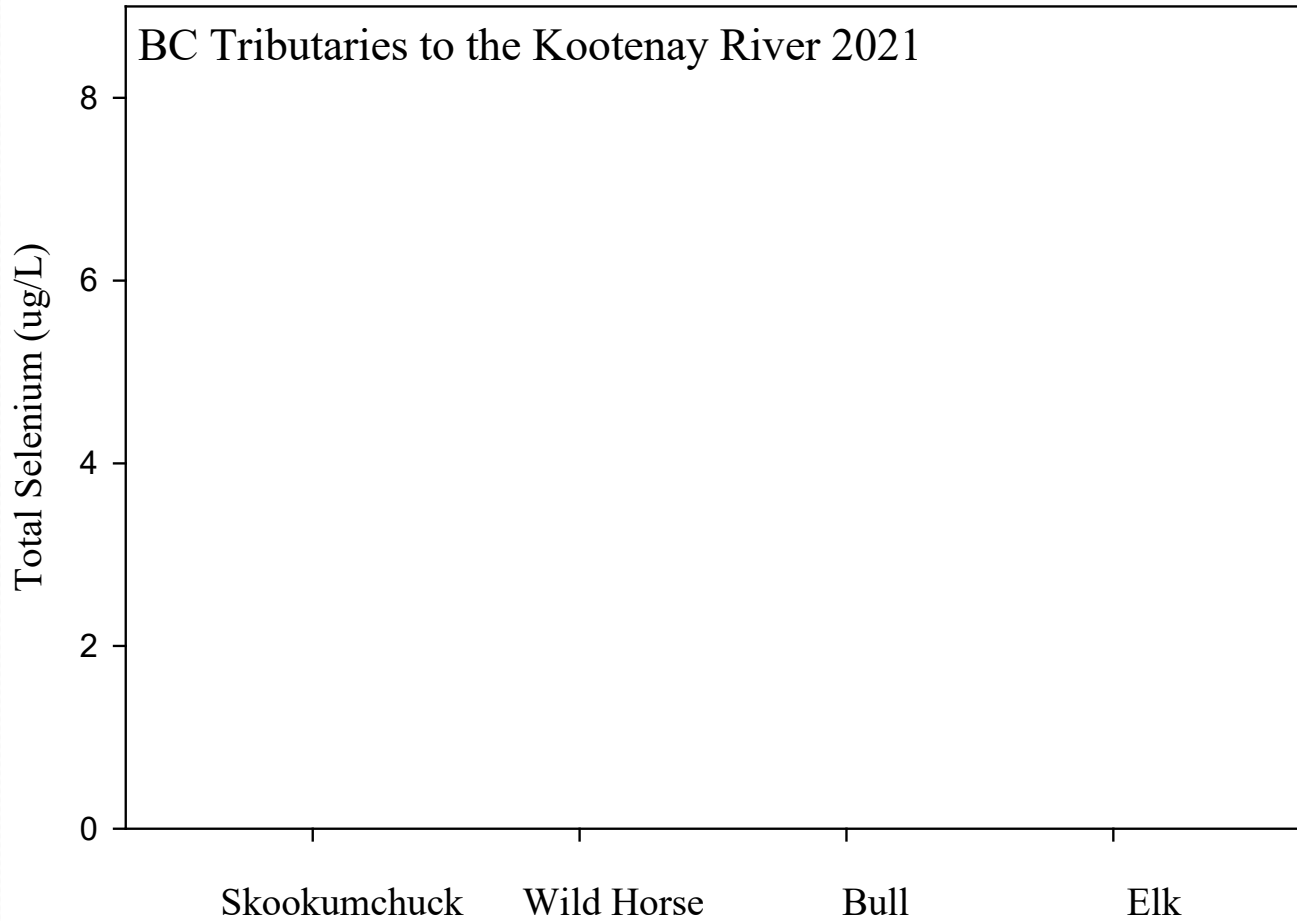
Water Chemistry

- Selenium-specific water samples collected monthly from Canal Flats, BC, to Kootenay Lake, BC;
- Selenium sampling includes total Se and Se speciation (one sample/site/metric);
- Selenium samples analyzed at Brooks Applied Labs in Bothell, WA.
- Water chemistry at key sites also includes N and P;
- 3 samples/site;
- N/P analyzed at IEH in Seattle, WA;

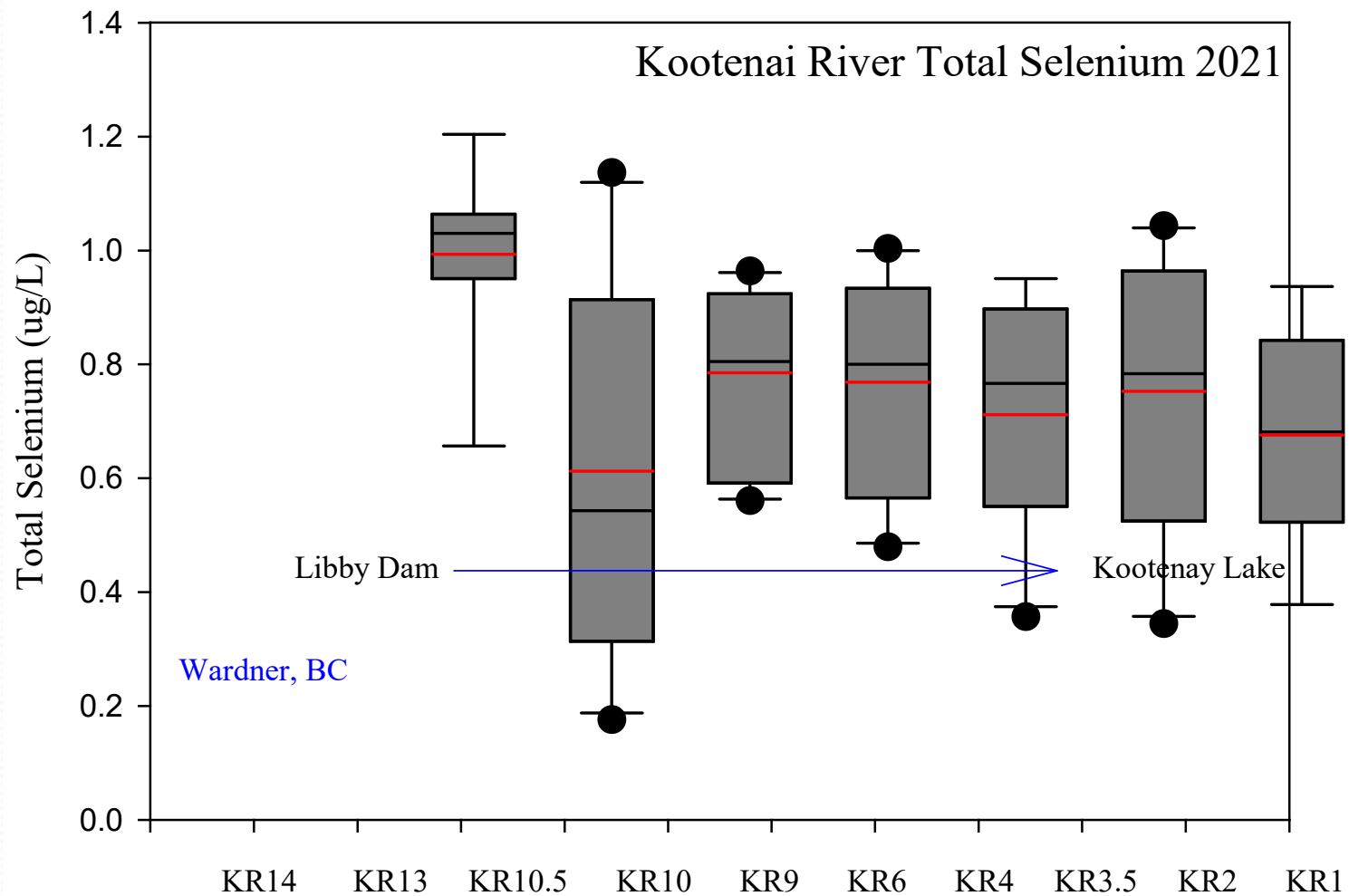
Kootenay/ai Basin– total Se



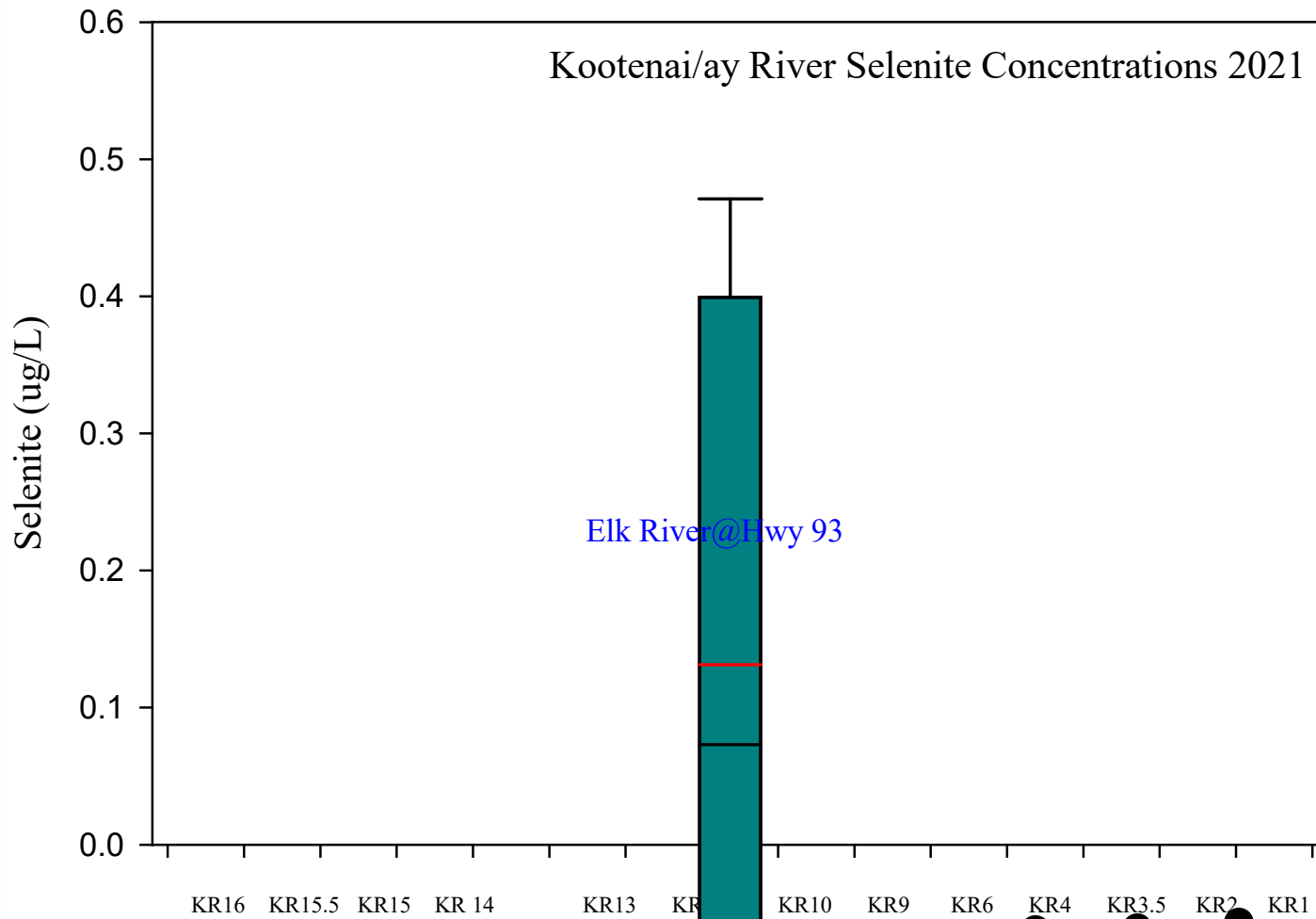
BC Tributaries - Se



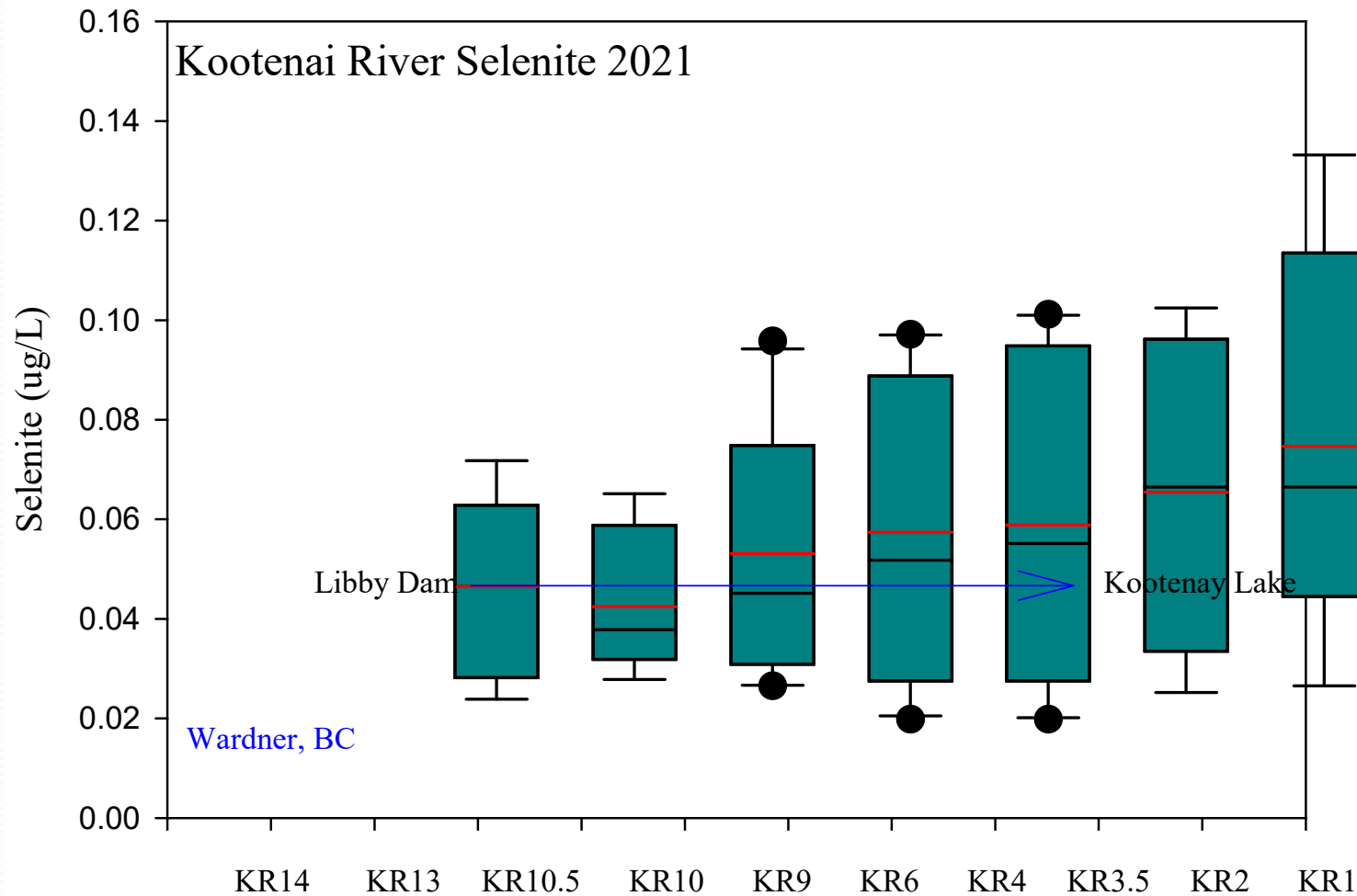
Lower Kootenai River— total Se



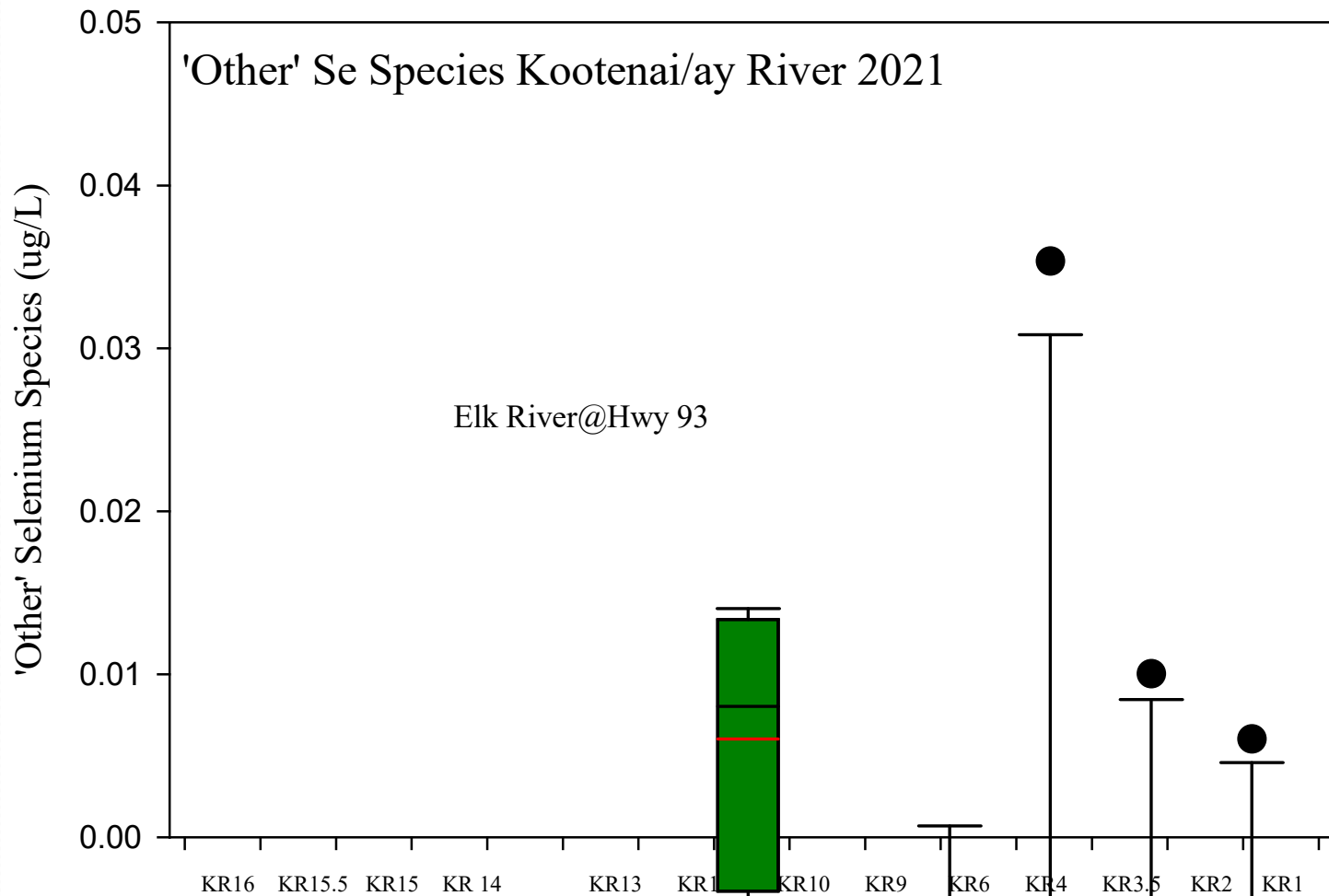
Kootenay/ai Basin - selenite



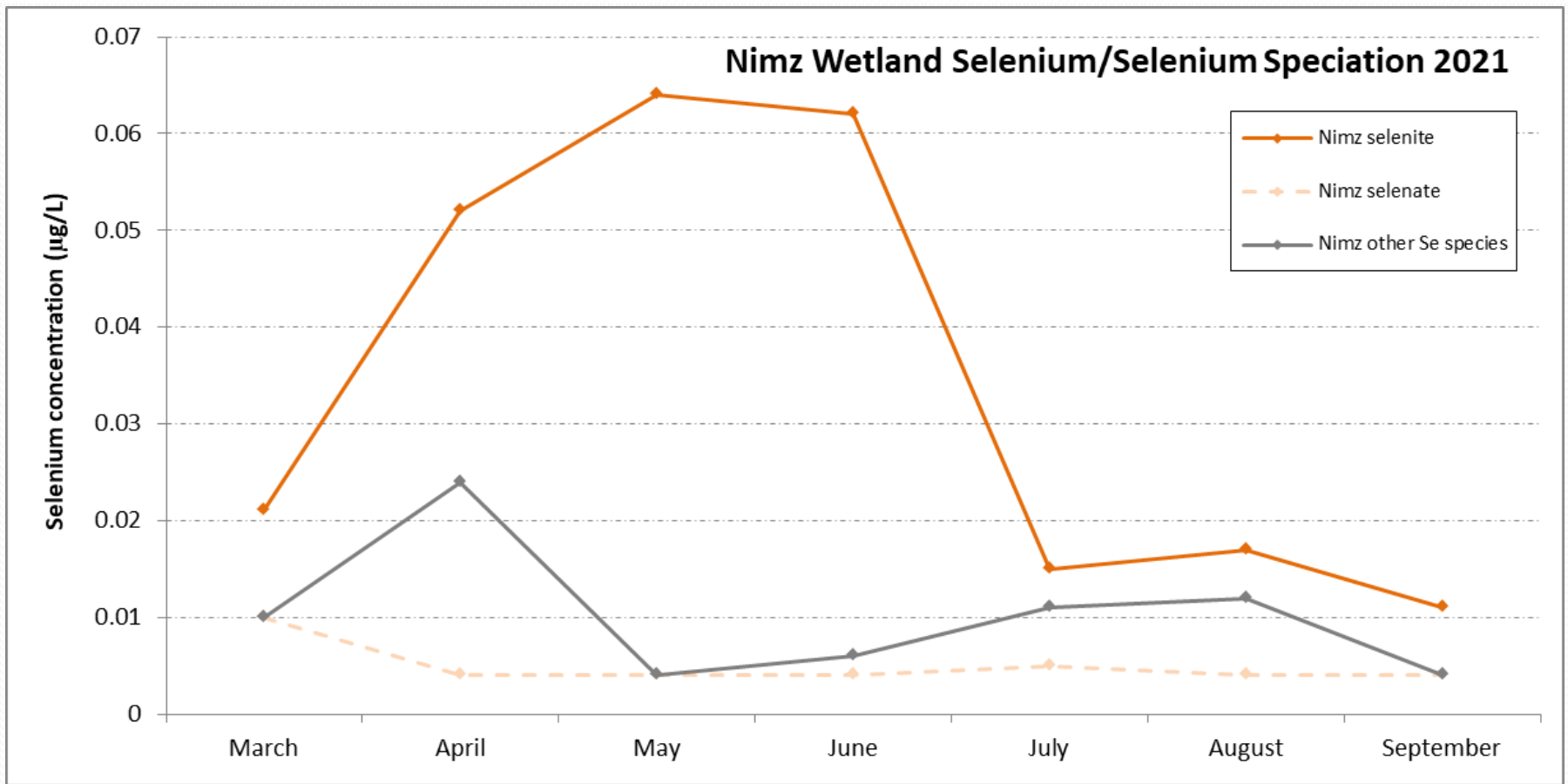
Lower Kootenai River - selenite



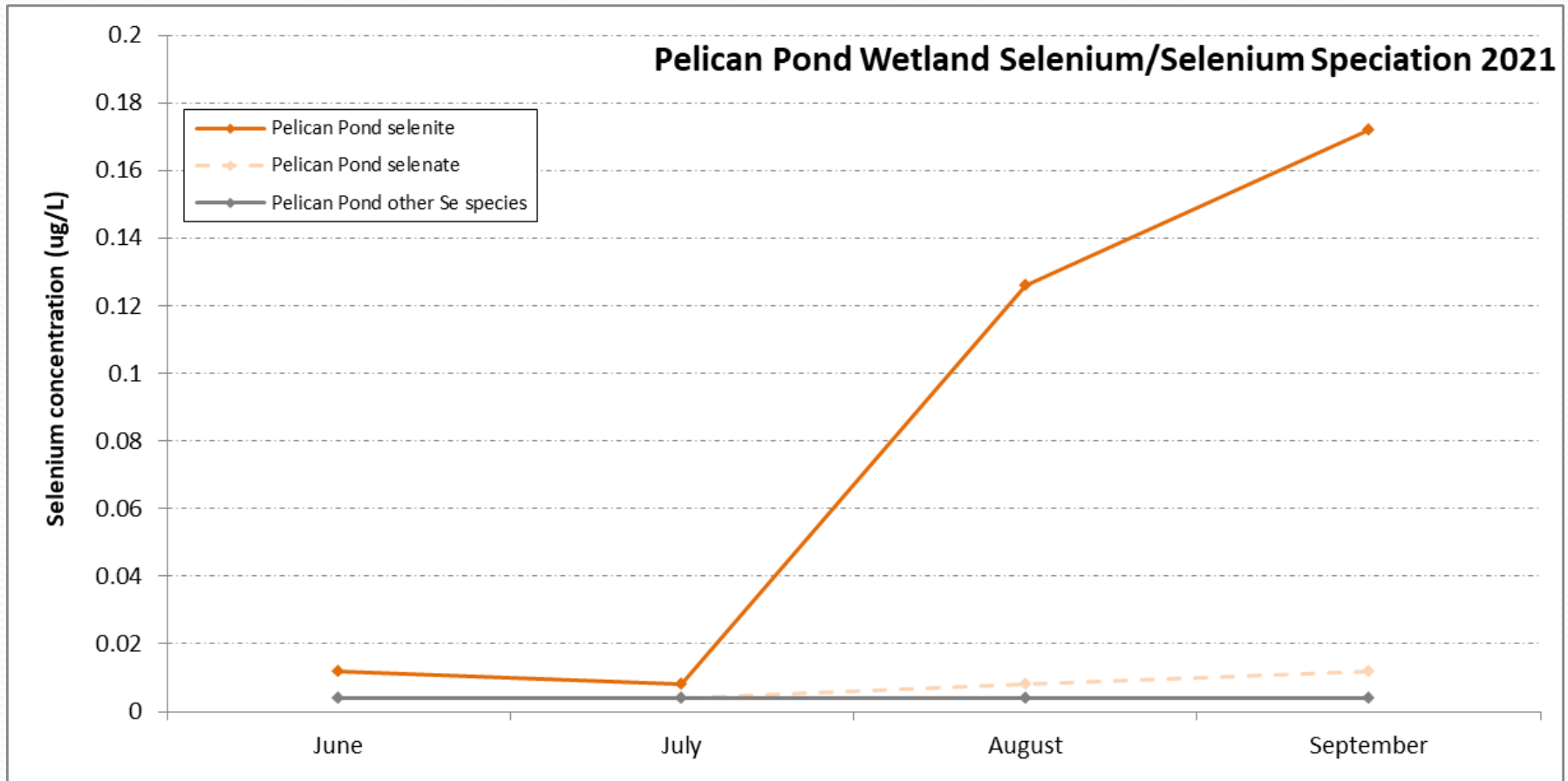
Water Chemistry – ‘other’ Se species



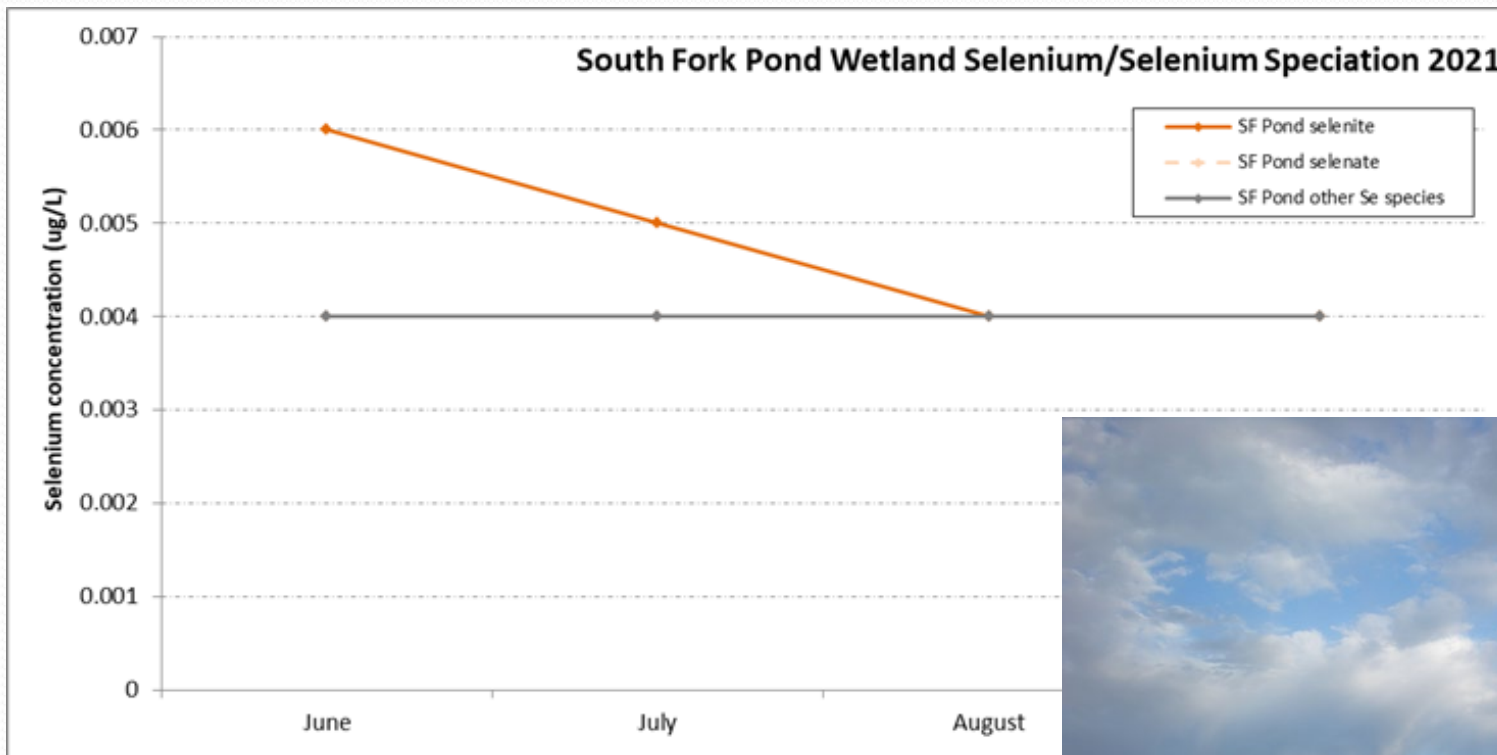
Water Chemistry - wetlands



Water Chemistry - wetlands



Water Chemistry - wetlands



****All samples @ the DL****



photo credit: Genny Hoyle

Periphyton

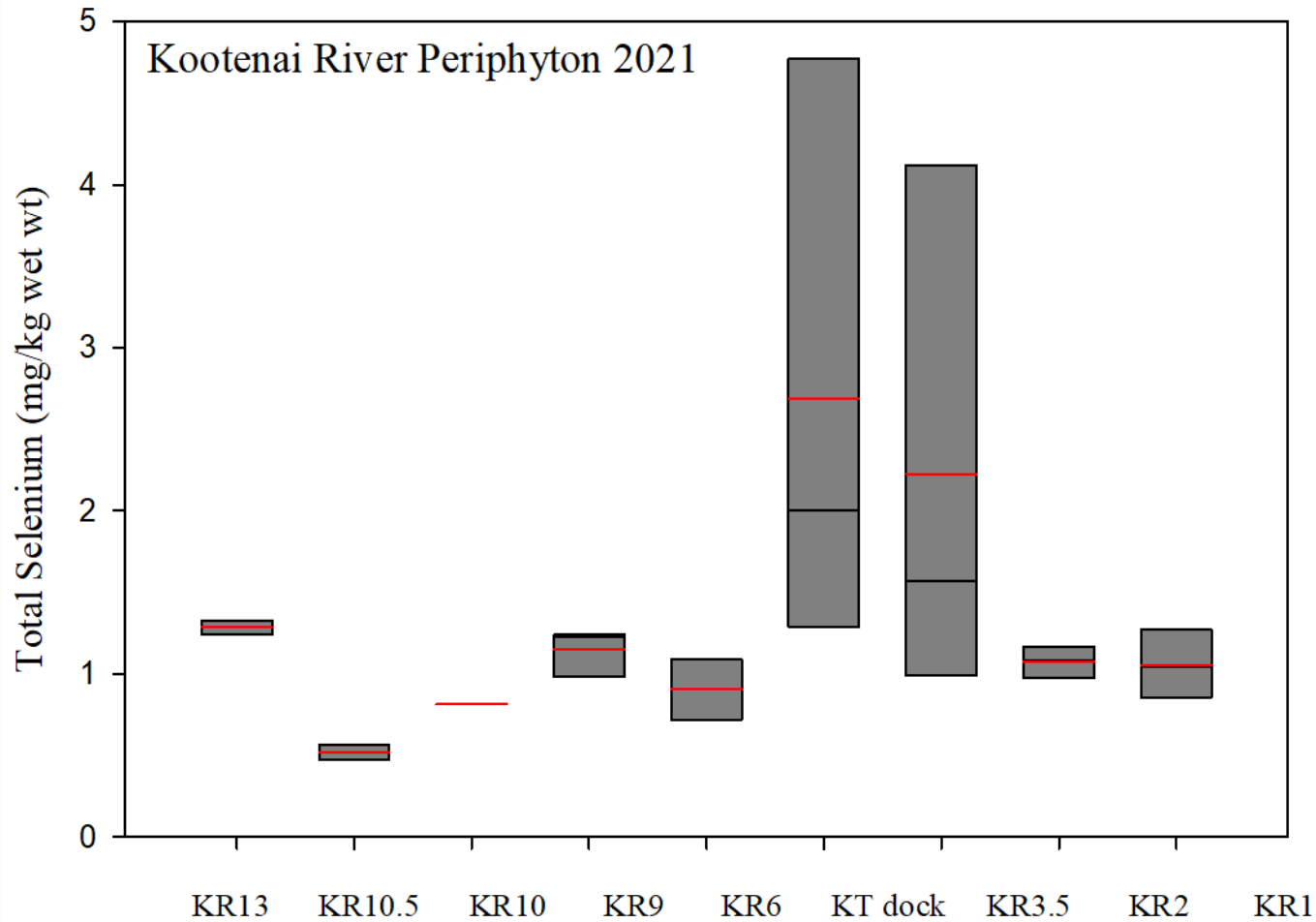
- 22 samples;
- Samples collected from substrates July through September 2021;
- 9 sites throughout the KR below Libby Dam;
- Brooks Applied Labs, Bothell, WA.



Periphyton



photo credit: Genny Doyle

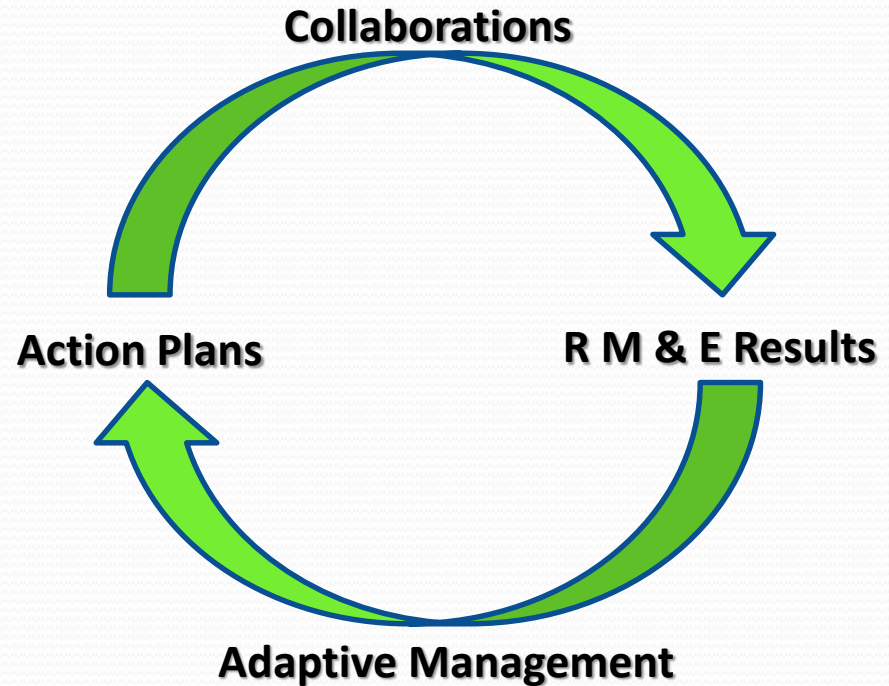


Kootenai Restoration Components

Contributing Programs

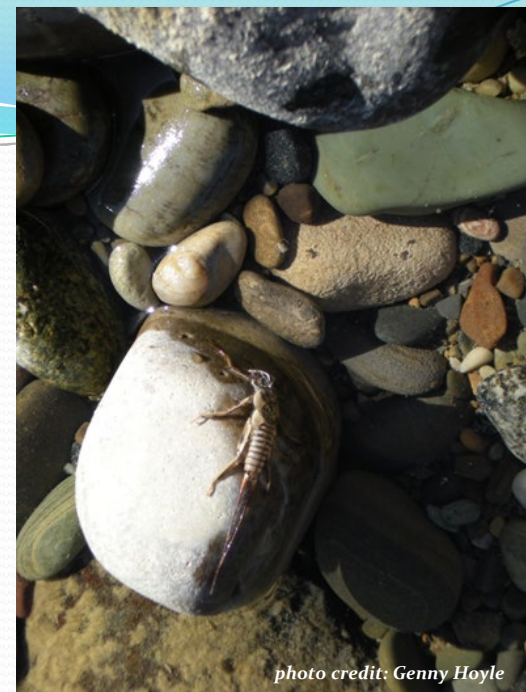
- ✓ Conservation Aquaculture
- ✓ Habitat Restoration
- ✓ Nutrient Enhancement
- ✓ Terrestrial & Riparian / Wildlife
- ✓ **CONTAMINANTS MONITORING**

Research, Monitoring and Evaluation completed by a host of collaborating agencies.



Future Monitoring

- Continue basin-wide Se water chemistry monitoring;
- Adding sulfate to the water chemistry;
- Continue /expand the periphyton sampling;
- Add zooplankton, benthic macros, gastropods, and crustaceans;
- 2022 field sampling of burbot eggs (IDFG/KTOI);
- 2022 KRWS broodstock egg sampling;
- Emphasis on habitat types.



Long-Term Goals

- Maintain a high level of involvement/government-level;
- Calculate trophic transfer functions (tff's) between trophic levels;
- Construct a general food web structure;
- Model food web and tff's to derive a site-specific and protective water column # for selenium;
- **What is protective for Kootenai River aquatic life?**

